

*Proposed*

**AMENDMENTS TO THE CLAIMS:**

1. (Currently Amended) A method of determining the oil fraction of a fluid emulsion comprising heavy oil/bitumen and water by direct measurement comprising the steps of:
  - (a) providing a low field NMR relaxometer;
  - (b) measuring and recording the  $T_2$  relaxation spectrum of the emulsion at a temperature allowing recovery of the  $T_2$  spectrum of the heavy oil/bitumen, substantially separate from a  $T_2$  water peak;
  - (c) determining a distinguishing  $T_2$  cutoff value;
  - (d) measuring the total amplitude ( $A_{oil}$ ) of the spectrum at  $T_2$  times less than and equal to the  $T_2$  cutoff value ( $A_{cutoff}$ ); and
  - (e) converting  $A_{oil}$  to a weight value by dividing  $A_{oil}$  by the amplitude index of an oil standard ( $AI_{oil}$ ), of known weight ( $AI_{cutoff}$ ); and
  - (f) using the weight value to determine the oil fraction of the fluid emulsion.
2. (Original) The method of claim 1 wherein the temperature is about 30°C and the  $T_2$  cutoff value is about 10 milliseconds.
3. (Currently Amended) A method of determining the water fraction of a fluid emulsion comprising heavy oil/bitumen and water by direct measurement comprising the steps of:
  - (a) providing a low field NMR relaxometer;
  - (b) measuring and recording the  $T_2$  relaxation spectrum of the emulsion;
  - (c) determining a distinguishing  $T_2$  cutoff value;
  - (d) measuring the total amplitude ( $A_w$ ) of the spectrum at  $T_2$  times greater than the  $T_2$  cutoff value ( $A_{cutoff}$ ); and

- (e) converting  $A_w$  to a weight value by dividing  $A_w$  by the amplitude index of a water standard  $(AI_w)$  of known weight  $(AI_w)$ ; and
  - (f) using the weight value to determine the water fraction.
4. (Previously Amended) The method of claim 3 further comprising the steps of determining the total weight of the sample and determining the oil fraction of the emulsion by subtracting the water fraction of the sample from the total weight of the sample.
5. (Currently Amended) An apparatus ~~for~~ determining by direct measurement the oil fraction of a flowing fluid emulsion comprising heavy oil/bitumen and water comprising:
- (a) a low field NMR relaxometer having a NMR magnet positioned in proximity to a channel through which the emulsion flows, said relaxometer for measuring the  $T_2$  spectrum of a ~~the~~ sample at a temperature allowing recovery of the  $T_2$  spectrum of the heavy oil/bitumen, substantially separate from a  $T_2$  water peak;
  - (b) means for identifying a distinguishing  $T_2$  cutoff value;
  - (c) means connected to the relaxometer for measuring total  $T_2$  amplitude below a the  $T_2$  cutoff value value, wherein a substantial portion of the spectrum attributable to the oil is at  $T_2$  values less than or equal to the  $T_2$  cutoff value; and
  - (d) means for converting the total  $T_2$  amplitude value to a weight value; and
  - (e) means for determining the weight value to determine the oil fraction of the fluid emulsion.
6. (Original) The apparatus of claim 5 wherein the  $T_2$  cutoff value value is about 10 milliseconds.

7. (Original) The apparatus of claim 5 wherein the relaxometer operates at less than about 2 MHz.
8. (Original) The apparatus of claim 7 wherein the relaxometer operates at about 1 MHz.
9. (Original) The apparatus of claim 5 further comprising a heater for heating the emulsion flow.
10. (Currently Amended) An apparatus for determining by direct measurement the oil fraction of a fluid emulsion comprising heavy oil/bitumen and water comprising:
  - (a) means for obtaining a sample of the emulsion;
  - (b) a low field NMR relaxometer ~~for~~ measuring the  $T_2$  spectrum of the sample at a temperature allowing recovery of the  $T_2$  spectrum of the heavy oil/bitumen, substantially separate from a  $T_2$  water peak;
  - (c) means for identifying a distinguishing  $T_2$  cutoff value;
  - (d) means connected to the NMR relaxometer for measuring total  $T_2$  amplitude below a the  $T_2$  cutoff value, wherein a substantial portion of the spectrum attributable to the oil is at  $T_2$  values less than or equal to the  $T_2$  cutoff value;
  - (e) means for converting the total  $T_2$  amplitude value to a weight value; and
  - (f) means for determining the weight value to determine the oil fraction of the fluid emulsion.
11. (Currently Amended) A method of determining by direct measurement the oil fraction and water fraction of a fluid emulsion comprising heavy oil/bitumen and water comprising the steps of:
  - (a) providing a low field NMR relaxometer;

- (b) measuring and recording the  $T_2$  relaxation spectrum of the emulsion at a temperature allowing recovery of the  $T_2$  spectrum of the heavy oil/bitumen substantially separate from a  $T_2$  water peak;
- (c) determining a distinguishing  $T_2$  cutoff value;
- (d) measuring the total amplitude ( $A_{oil}$ ) of the spectrum at  $T_2$  times less than and equal to the  $T_2$  cutoff value; ( $A_{oil}$ );
- (e) converting  $A_{oil}$  to a weight value by dividing  $A_{oil}$  by the amplitude index of an oil standard ( $AI_{oil}$ ) of known weight ( $AI_{oil}$ );
- (f) measuring the total amplitude ( $A_w$ ) of the spectrum at  $T_2$  times greater than the  $T_2$  cutoff value ( $A_w$ ); and
- (g) converting  $A_w$  to a weight value by dividing  $A_w$  by the amplitude index of a water standard ( $AI_w$ ) of known weight ( $AI_w$ ); and
- (h) using the oil weight value and the water weight value to determine the oil fraction and water fraction respectively.

**BENNETT JONES**

**FAX MESSAGE**

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FROM Edward (Ted) Yoo

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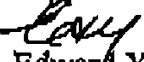
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Application No.: 09/852,339  
Filing Date: May 11, 2001  
Inventor (first named): Mirotchnik  
Group Art Unit: 2859  
Examiner Name: FETZNER, Tiffany A.  
Attorney Docket No.: 45074.32

Dear Examiner Fetzner,  
Further to our telephone conversation of this morning, I enclose proposed amendments to the claims in accordance with our discussions.

I appreciate your careful examination of this case.

  
Edward Yoo 41435

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